Developments in Geotechnical Engineering

Jay Ameratunga
Nagaratnam Sivakugan
Braja M. Das

Correlations of Soil and Rock Properties in Geotechnical Engineering

Springer

Developments in Geotechnical Engineering

Series editor
Braja M. Das, Henderson, USA
Nagaratnam Sivakugan, Townsville, Australia

More information about this series at http://www.springer.com/series/13410

Jay Ameratunga • Nagaratnam Sivakugan
Braja M. Das

Correlations of Soil and Rock Properties in Geotechnical Engineering

Springer

Jay Ameratunga
Golder Associates
Brisbane, QLD, Australia

Nagaratnam Sivakugan
James Cook University
Townsville, QLD, Australia

Braja M. Das
California State University
Henderson, CA, USA

ISSN 2364-5156 ISSN 2364-5164 (electronic)
Developments in Geotechnical Engineering
ISBN 978-81-322-2627-7 ISBN 978-81-322-2629-1 (eBook)
DOI 10.1007/978-81-322-2629-1

Library of Congress Control Number: 2015951662

Springer New Delhi Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer (India) Pvt. Ltd. is part of Springer Science+Business Media (www.springer.com)

Preface

Geotechnical engineering has grown rapidly in the past half century with the contribution from academics, researchers and practising professionals. It is still considered a combination of art and science with research and observations in the field refining and improving geotechnical design. Although in situ and laboratory geotechnical testing still remain the two preferred methods of determining design parameters, empiricism has a unique and a big role to play in geotechnical engineering.

Geotechnical literature is full of empirical equations and graphs, and they are used regularly by practitioners worldwide. These are derived based on laboratory or field data, past experience and good judgement. Where little or no geotechnical information is available, or where reasonableness of a test result needs to be checked, these empirical equations provide an alternative very useful to the engineer. For some parameters, you may be confronted with several empirical equations, and it is a good practice to clearly state the source so that the readers can make their own judgement.

The main objective of this book is to provide correlations commonly used by geotechnical practitioners to assess design parameters important in the geotechnical design activities. It is intended mainly for the practitioners although its value extends to academics and researchers as well. We have arranged the chapters on the basis of the main types of in situ tests with laboratory tests on soil and rock given two separate chapters. In Chapter 2, we have provided a brief overview of the geotechnical properties commonly determined in the laboratory, their relevance in soil mechanics and laboratory tests for determining them. It gives the necessary background for the chapters that follow.

Acknowledgements

We are thankful to Professor Harry Poulos who provided valuable suggestions on the first draft. Thanks are also due to Dr. Chris Bridges and Thayalan Nallarulanatham for assisting and reviewing some of the chapters. Allan McConnell of Insitu Geotech Services and Yvo Keulemans of Cone Penetration Testing Services have provided some valuable pictures for this book. We are thankful to them for their contributions. Finally we would like to thank the staff at Springer for their assistance and advice, especially Swati Meherishi, senior editor, and Kamiya Khatter, senior editorial assistant.

Brisbane, QLD, Australia — Jay Ameratunga
Townsville, QLD, Australia — Nagaratnam Sivakugan
Henderson, CA, USA — Braja M. Das

Contents

About the Authors

Jay Ameratunga has been a practising civil engineer for over 35 years specialising in geotechnical engineering. After graduating from the University of Ceylon, Peradeniya in Sri Lanka, he obtained his master's at the Asian Institute of Technology, Bangkok, and obtained his Ph.D. from Monash University, Australia. The early part of his career was spent in Sri Lanka before joining the Coffey Group in 1989. He had been involved with the investigation, design and construction of many major projects, especially in Australia and New Zealand, including the Gateway Upgrade Project and the Future Port Expansion Seawall Project in Brisbane and the State Highway 16 Project in Auckland. He is currently attached to Golder Associates. He works closely with universities on major research projects and mentors Ph.D. students and young engineers. He has also been a visiting lecturer at Queensland University of Technology, Brisbane. He has co-authored close to 50 technical papers on soft clay, reclamation and ground improvement and has presented in conferences in Australia, New Zealand and at other international venues. He is a past chair of the Australian Geomechanics Society, Queensland Division, a member of the Australian Standards Committee for Geosynthetics and a fellow of the Institution of Engineers, Australia.

Nagaratnam Sivakugan received his bachelor's degree in civil engineering from the University of Peradeniya, Sri Lanka, with first class honours, and M.S.C.E and Ph.D. from Purdue University in West Lafayette, Indiana. His writings include five books, 110 refereed international journal papers, 75 refereed international conference papers and more than 100 consulting reports. As a registered professional engineer of Queensland and a chartered professional engineer, he does substantial consulting work for the geotechnical and mining industry in Australia and overseas, including the World Bank. He is a fellow of the American Society of Civil Engineers and Engineers Australia. He has supervised 13 Ph.D. students to completion at James Cook University, Queensland, Australia, where he was the head of civil engineering from 2003 to 2014.

Braja M. Das is dean emeritus of the College of Engineering and Computer Science at California State University, Sacramento. He received his M.S. in civil engineering from the University of Iowa and his Ph.D. in the area of geotechnical engineering from the University of Wisconsin. He is the author of a number of geotechnical engineering texts and reference books and has authored more than 250 technical papers in the area of geotechnical engineering. His primary areas of research include shallow foundations, earth anchors and geosynthetics. He is a fellow and life member of the American Society of Civil Engineers, life member of the American Society for Engineering Education and an emeritus member of the Chemical and Mechanical Stabilization Committee of the Transportation Research Board of the National Research Council (Washington, D.C.). Dr. Das has received numerous awards for teaching excellence, including the AMOCO Foundation Award, the AT & T Award for Teaching Excellence from the American Society for Engineering Education, the Ralph Teetor Award from the Society of Automotive Engineers and the Distinguished Achievement Award for Teaching Excellence from the University of Texas at El Paso.